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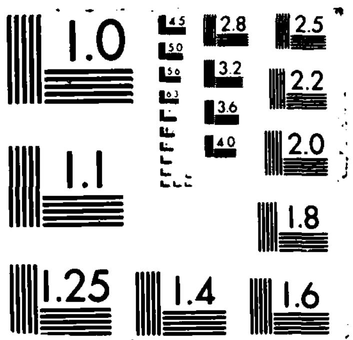
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AD-A181 418

AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

A DECISION-MAKING METHODOLOGY FOR LONG-RANGE PLANNING

MAJOR CRAIG S. GHELBER 87-0960

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AUTHOR(S) MAJOR CRAIG S. GHELBER

FACULTY ADVISOR MAJOR TERRY L. BROOKS, 3823 ACSC STUS

SPONSOR LT COL BARRY E. BERKOWITZ, SSC/ACC

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Long-range planning has become an important part of the management process for Chief Executive Officers and top decision-makers throughout business and government. However, most find the necessities of day-to-day operations leave little time for the lengthy, time-consuming steps required by most analytical methodologies. The report develops a systematic methodology that can be used to organize strategies in a way that decision-makers can assimilate a large number of alternatives and make decisions at a macro-level appropriate for long-range planning

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PREFACE

Planning for the future is receiving great emphasis in the United States military. Each service has a long-range planning element with direct organizational lines to its senior leaders. Their mission is to provide the senior leadership with information that will assist them in making decisions and establishing guidance to direct the course of the organization toward his or her vision of the future. In the Air Force, not only is the Pentagon directly involved in looking to the future, but, in addition, each major command has an organization whose charter is to look beyond the budget process. This level of emphasis is typical in industry as well.

Unfortunately, the amount of direct decision-maker involvement in the process is limited because of the time required for day-to-day operations. This report was written to investigate a way whereby the senior decision-maker can get involved in the process without being involved in laborious, and often confusing analytical techniques. The goal is to develop a methodology that is systematic, simply evaluated, and not time-intensive for the decision-maker; and will still allow the analysis of a large number of alternatives.

In 1983, the author of this report first used a form of this methodology in a briefing developed for the Secretary and Chief of Staff of the Air Force on strategic alternatives. The basis of the presentation was a matrix array of alternative strategies. The briefing and analytical approach was well received by the senior leadership. This report will expand on that methodology and offer considerations and limitations for its use.

ABOUT THE AUTHOR

Major Craig S. Ghelber, currently a member of the Air Command and Staff College class of 1987, graduated from the United States Air Force Academy in 1972 with a bachelor's degree in mathematics. He received his master's of science degree in 1981 from the Air Force Institute of Technology (AFIT) in operations research, strategic and tactical sciences, and earned the distinguished graduate award. His thesis was entitled "A Methodology for Validation of Complex Multi-Variable Military Computerized Models," and was used as a textbook for computer simulation courses at AFIT.

His next assignment was to Headquarters Air Force in the Long-Range Plans Division as an operations research analyst. There, he was instrumental in bringing analytical techniques to the long-range planning process. Working with contractors, he developed a computerized program that was used to evaluate top decision-maker views of the future world environment. The product was published in the USAF Global Assessment, an Air Force long-range planning document. While a member of the division, Major Ghelber published a paper in the Defense Intelligence Agency Forecasting Seminar Proceedings on the pitfalls of decision analysis. In addition, he addressed the 47th Military Operations Research Society symposium and published a paper in their proceedings on analytical techniques. He was also the chief editor of Air Force 2000, a study chartered by the Chief of Staff of the Air Force.

Major Ghelber expanded his interest in decision analysis while at the Pentagon. As the division briefer for the Air Force long-range planning process and Air Force 2000, he briefed senior Air Force and sister service leaders, as well as top decision-makers throughout industry. He observed that decision-makers, generally, had an understanding and respect for analytical studies; however, seldom had the time or desire to sit through long descriptive sessions. He also observed that they often had an ability to extract great amounts of knowledge from simple charts and graphs. Major Ghelber's original thesis in this report is the collection of his knowledge and experience on the subject.

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Chapter One

INTRODUCTION

Long-range planning (strategic planning) has become an important part of the management process for Chief Executive Officers (CEOs) and top decision-makers througnout business and government.

> When decisions are made within the context of a strategic vision and with a full consideration of the long-term consequences of each decision, greater coherency in planning and policymaking results. However, most leaders of governmental organizations are caught up in the daily responsibilities and spend little time in creating a strategic plan for their agency or service. Leaders who are captives of an overly full daily schedule fail to plan systematically. A systematic long-range planning process is essential for creating and maintaining a strategic vision and for building a strategic program. (3:18-19)

Unfortunately, today's top decision-makers find the necessities of day-to-day operations leave them little time for the lengthy, time-consuming steps required by most analytical methodologies. Therefore, most efforts have centered on taking snap-shots of the future--few have emphasized systematic techniques. (6:1) The purpose of this research effort is to develop a systematic methodology that can be used to organize strategies in a way decision-makers can assimilate a large number of alternatives, analyze consequences, recognize trends, and make decisions at the macro-level--appropriate for achieving long-range objectives.

LONG-RANGE PLANNING DEFINED

Long-range planning is the process of developing long-term objectives and choosing strategies that direct the organization toward those objectives. The horizon for long-range planning, however, can differ from organization to organization. For example, "Most government officials hold their positions for relatively short periods of time and tend to have planning horizons that generally correspond to the amount of time they expect to hold their present jobs." (3:20) One could argue that a U.S. president's view of long-range planning is to look out no more than four years. Whereas, technology planning for the

future may look out 30 years or more. For the purpose of this research, the long-range planning horizon is defined as looking far enough into the future to ensure decisions do not necessitate immediate budgetary funding or immediate reorganization to obtain objectives. Said another way, decisions are made to provide the basis for short- and mid-range planning.

It follows, then, that long-range objectives and strategies must be broad in scope. A decision to build a new factory or to allocate a specific amount of the budget to procuring a squadron of aircraft is not considered a long-term objective or strategy (this does not preclude a short- or mid-term action from having a long-term consequence). In the context of the national vital interest of maintaining a strategic balance with the Soviet Union, an example of a long-range objective might be: "Develop a manned bomber capable of penetrating future Soviet defenses." This could also be restated as a short-term objective, but is equally appropriate looking out 20 or more years. It is broad in scope and in a future context could imply developing space delivery vehicles or stealth bombers.

A strategy to complement this objective might be: "Pursue research that protects against a Soviet technological breakout." This may mean to allocate budget dollars this year for research and development, or keep an eye open for developing technologies that have a potential for future capabilities.

Successful long-range planning requires the decision-maker to analyze all alternatives and their consequences. Based on insight, experience, and clear objectives, he can then make reasoned decisions. These decisions may be to pursue an objective directly or to defer action for an indeterminate time. Furthermore, by the nature of long-term objectives, decision-makers can choose to change course down stream, yet still be able to achieve the overall objective.

THE PROBLEM DEFINED

It would now seem a fairly easy process for a decision-maker to gather his top executives and define the path the organization will take toward the future. However, due to the complexity of today's markets, economic systems, or threat environments, and coupled with the amount of information made available to decision-makers because of advancing computer technology, it has become nearly an impossible task to assimilate all the alternatives available to a decision-maker.

Despite the emphasis on long-range planning, there are few methodologies available that directly address this area of decision-making. Generally, methodologies fall into two categor-

ies: analytical and non-analytical. Each approach has benefits and limitations.

Analytical methodologies typically involve a form of forecasting or decision analysis. Forecasting, a general term for predicting the future, is also an operations research technique that involves computer simulation. It is used quite extensively in economic predictions; however, requires little decision-maker input. It is, unfortunately, only as good as the quality of the model (usually unknown to the decision-maker), and the validity of the range and mix of variables. In addition, most senior executives are wary of the "garbage-in-garbage-out" reputation of computer simulations.

Decision analysis methodologies help top decision-makers organize and focus their preferences, but require time-consuming elicitation sessions. Furthermore, decision analysis is most often used to determine a decision-maker's willingness to take risk on a specific alternative, versus choosing from a spectrum of alternatives. (1:1)

Non-analytical techniques generally involve choosing a global future (a snap-shot of the future), then determining a desirable course of action. Technological advances or catastrophic social or political events usually dominate this vision of the future, and often limit perspective. Ad-hoc study groups are generally chartered to undertake this type study. Although this is an excellent way to get large numbers of people involved in the long-range planning process, which is important, these studies lack a systematic framework for presenting information to decision-makers for the decision-making process.

In summary, there is a need for a systematic approach to long-range planning that is not steeped in quantitative mathematical techniques that attempt to substitute for human judgment. The question becomes one of quantitative versus qualitative requirements for long-range planning. It is asserted here, and discussed later, that for the purpose of long-range planning, data can be presented in a qualitative manner and still provide the decision-maker with the level of information required for successful decision-making.

AIR FORCE LONG-RANGE PLANNING

One of the first Air Force efforts at long-range planning began in 1943 when General Hap Arnold commissioned Dr. Theodore von Karman to put together an ad-hoc group of the best scientific minds in America to chart a technological course for a soon to be independent Air Force. From Toward New Horizons, the results of von Karman's efforts, came the concepts for ICBMs, unmanned aircraft, and the Air Force Institute of Technology, to name just

a few. Other ideas met with less success, for example, nuclear powered aircraft. (4:--) It may also have been this report that set laser technology back several years when it suggested there were no weapons applications for this technology.

Today, the Air Force is actively involved in an institutionalized effort at long-range planning. Under the Director of Plans, Headquarters United States Air Force, the Long-Range Plans Division is charged with looking out 10 to 25 years and developing objectives for the Secretary and Chief of Staff of the Air Force. With a few exceptions, discussed briefly in the Preface, their approach has been a non-analytical one. Ad-hoc studies and global futures are used as a basis for projecting the future.

OVERVIEW

Although each decision-making technique has its strengths and may be appropriate under certain circumstances, no one technique provides all of the following: an array of the decision-maker's alternatives, the consequences of any particular decision, trend analysis across the spectrum of alternatives, and the utility for the decision-maker to apply his experience and insight in a relatively short session. Chapter Two will survey the literature for human engineering techniques that can be used to assist decision-makers in assimilating large amounts of information. In Chapter Three a framework for the methodology is developed. An example is presented to demonstrate problem formulation and illustrate the scope of this technique. The final chapter will discuss other applications and considerations for the use of this methodology.

Chapter Two

A HUMAN FACTORS APPROACH

INTRODUCTION

As discussed above, computer and communication technologies have improved our ability to analyze problems, develop large numbers of alternatives, and transmit them with great speed. Decision-makers are often overwhelmed with information, and, unfortunately, this overflow can be as big a problem as not having the information. Furthermore, the data provided usually has no priority associated with the value of the information or guarantee of validity; therefore, decision-makers can and often do get trapped into making choices based on the wrong information.

Generally, there have been two approaches to addressing this problem: artificial intelligence and human engineering (sometimes called ergonomics). Artificial intelligence techniques are being studied that can help reduce the workload by eliminating the less useful information, but this sophisticated technology is far from being available for all applications.

Human engineering is defined as the "design of man-made objects, facilities, and environments to enhance the functional effectiveness with which people can use them." (2:4) An example of this technique in common use is a graph. A graph can provide a decision-maker a great quantity of data at a glance.

CODING TECHNIQUE

Coding has been used throughout the history of man. Cave drawings, alphabets, and mathematical symbols are all examples of man's attempt to present information indirectly to enhance his functional effectiveness. Although, "there are many sources of information that people can sense directly, there are many circumstances where information must be presented indirectly to be of any use." (2:40-41)

- Beyond view: On a war gaming board, models of tanks are placed on a three dimensional map so tacticians can visualize the battle.

- Excessive noise: In airborne radars used by fighter aircraft, moving target indicators are used to eliminate the noise of ground returns and to display only returns that have a velocity.

- Too large: A bar chart is a good example. If words and equations were used to describe the magnitudes and relationships between things easily represented on a bar chart, pages of text would be required.

However, coding can be a trade-off. In order to present information that may otherwise be beyond our senses, we often lose specificity for the sake of generality.

Again, this becomes a question of quantitative versus qualitative information. An example of a quantitative display of exact information would be a speedometer on a car or a RPM gauge on an aircraft. A simple example of qualitative display would be the auto oil light. If the light is not illuminated we know the oil pressure or quantity is adequate, but when the light comes on we are made aware there is a problem. Generally, this is all the information a car owner needs to know to make decisions concerning the condition of his car with respect to the oil system. (1:67,75)

The purpose of this research is not to explore the science of ergonomics or to make the reader an expert on human engineering factors, but rather to use a coding strategy, a principle validated by experts. (2:104)

With this qualification, color coding has been chosen as the technique to be used for the development of this methodology. "Color coding is very useful in some contexts, particularly in searching, scanning, or locating related tasks." (2:104) The stop light is a good example of color coding. There is a clear transfer of information at a glance (if you are not color blind), yet no attempt to explain the reason why it is a good idea to stop is offered to the motorist.

DISPLAY TECHNIQUE

Now that a rationale for using a color coding strategy for data presentation has been discussed, the next step is to determine how the coded symbols will be arranged or displayed.

"A display does not transmit information as such, but rather presents stimuli which may be meaningful to the receiver." (2:42) For qualitative information, displays should reflect the ". . . approximate value and trend of the variables." (2:42)

The display must organize the information represented by coded symbols in the most meaningful manner for the decision-maker.

Although there is extensive literature that describes the principles of arranging data, suffice it to say that whether it is arranged by importance, frequency of use, function, or sequence, an analyst must use the method that most clearly presents the information for the decision-maker. This could vary depending on the objective of the decision-making session.

The requirement, then, is to choose a framework for the salient structure of data. There will be no attempt to justify one structuring method over another, rather to assert several reasons why a chart or matrix organization will be used for this methodology. First, a matrix format is understandable by today's decision-makers who are chart and graph "wise" because of their wide use in business and finance. Next, a matrix facilitates what ever principle of arrangement is desired. Finally, using color coding, relational and trend information can be easily displayed. The benefits of matrix organization will be demonstrated in the next chapter.

SUMMARY

This chapter has provided the rationale for using color coding and a matrix organization for assimilating large amounts of information for decision-makers. The limits of this approach have also been mentioned. It is important to understand that depth and specificity of this form of qualitative data presentation is not particularly appropriate for all decision-making situations, but is appropriate for long-range planning as defined in Chapter One.

Chapter Three

METHODOLOGY

INTRODUCTION

In this chapter, the reader will be led through a simple example to demonstrate how to apply the decision-making matrix methodology--referred to hereafter as DMM. Then, several suggested implementation considerations will be outlined. But first, before jumping head-long into the example, it is important to lay the foundation for a basic understanding of the analytical process.

The cornerstone of the analysis process is, obviously, the analyst. Although an analyst is often characterized as a "number cruncher," little of his or her time is actually spent doing calculations. When an analyst tackles a problem, much of his effort is spent researching, organizing, and working in concert with members of the analysis team. The concept of an analysis team is important, because it is impractical to expect one person to be an expert in analytical techniques and at the same time expert in the subject being studied, plus have the management and leadership skills required to bring a study to fruition. Therefore, a team needs to be chosen to have available all the specific skills required.

The next step is to define the scope and depth of the problem. This may be the most important step in the process and can help avoid future pitfalls. Furthermore, every member of the team should have a clear understanding of the task so there is commonality in the effort.

Next, the analyst must select the right analytical technique. This is a particularly difficult job, because the common tendency is to adapt the problem to a methodology (one the analyst is comfortable and familiar with), rather than find the appropriate technique for the task. Once data is collected and appropriately integrated with the methodology, only then are numbers crunched or computer programs run.

The final step is the analysis and presentation. It is at this point that the knowledge of the analyst is most critical. He must be able to put the numbers, symbols, or whatever result is obtained into perspective for the decision-maker. The follow-

ing discussion will demonstrate this process and lead to an application of the DMM methodology.

THE ANALYTICAL PROCESS

Typically, an analysis shop can expect management to task them with little more than a broad, and sometimes ambiguous, description of the problem. For illustration purposes, suppose the Chief of Staff sent down a tasking that read, "In light of the President's Space Defense Initiative (SDI), what happens to our nuclear strategy?" The first step, as discussed above, is to choose the analysis team. As a minimum, the team selected to respond to this tasking should include: a team chief--possessing management and leadership skills, an operations researcher--knowledgeable in analytical techniques, and experts--versed in the theory of nuclear strategy and weapons technology. Others can be added as required.

The next step is to define and refine the problem. If the team does not have a clear understanding of their task, then it is likely they will answer the wrong question. Narrowing the topic, defining variables, bounding parameters, scoping the depth of solution required, and other pertinent refinements are necessary in this early stage. Expanding on the above example, after in-depth discussion by team members, it is determined that the Chief of Staff is interested in expanding his own understanding of deterrence, and wants to be made aware of alternative strategies and their consequences--in light of SDI. Furthermore, the team determines that the perception of stability is key to the understanding of deterrence. For example, the U.S. may consider SDI stabilizing and desirous; whereas, the Soviets may see this as being advantageous to the U.S. and, thus, destabilizing. Therefore, the objective is redefined to read: "Determine strategies that will ensure stability and strategic balance with the Soviet Union."

It is important at this point for the team chief to review their progress with the decision-maker to ensure the team has captured, precisely, the essence of the tasking, and has not gone astray in its zeal. Also, it may be an opportunity for the decision-maker to rethink his guidance or redirect the effort.

With assurance the team is on the right track, the third step is to choose an appropriate analysis methodology. There are many techniques possible for this problem. An operations researcher often has in his "bag of tricks" techniques ranging from simple statistical calculations to complex computer simulation. Knowing things like data availability, the precision required to meet the tasking, the availability of expert input, and the expectation of the decision-maker as to the form and forum for presentation, can dictate the methodology used. Again, a major

consideration, as discussed in Chapter Two, is the quantitative versus qualitative issue. If the task is to measure test results, compare cost estimates, or average performance data, then statistical analysis or deterministic algorithms should be used. However, if the analysis involves decision-maker participation, it is critical that he be provided the best information in a form that draws on his judgment and insight.

At this juncture, the analyst should take a macro-view of the problem and decide if it falls into our framework for a long-range planning problem. It should be clear that it will take years to develop the appropriate technologies required to change current strategy. Also, defining goals and direction for the future is really the essence of the problem. Furthermore, examining a large number of alternatives and their consequences is inherent in the tasking. Finally, based on his insight and judgment, the decision-maker will have to organize the facts to come to his own conclusions. Thus, we have arrived at the basic criteria established in Chapter One for the use of the DMM methodology.

METHODOLOGY APPLICATION

Now that the objective is defined and the methodology chosen, it is time to collect the experts around the chalkboard and apply the methodology. Table 1 summarizes five alternatives that could be chosen to achieve the objective. Obviously, an in-depth study of the subject would produce many other strategy alternatives, but for discussion purposes a simple model will suffice.

The next step is to arrange the strategies in the matrix (Figure 1). There are two reasons to emphasize the ordering. First, it is easier when filling in the matrix to proceed in logical increments. This will help the respondents organize their views. Second, as will be discussed later, valuable trend information can be recognized based on the organization of the strategies. Generally, ranging them from one extreme to the other will best serve both purposes.

Finally, the analyst has reached the point where he needs to fill in the matrix. Particular care should be taken in phrasing the questions to the experts. For example, to fill in the first block (upper left-hand corner), the question might be stated as follows: "If the U.S. had an offensive strategy and the Soviets had an offensive strategy, would it be a stabilizing situation from the U.S. perspective?" If the answer is yes, code that intersection with a green symbol. Table 2 illustrates the color code responses based on the discussion from Chapter Two. Yellow is used if the respondent does not feel a clear yes or no answer is appropriate. It is critical the respondents be reminded their

OFF:	**OFFENSIVE STRATEGY, 100% OFFENSIVE WEAPONS, NO DEFENSE (MUTUALLY ASSURED DESTRUCTION)**
PT DEF:	**OFFENSIVE STRATEGY WITH POINT DEFENSE OF MAJOR CITIES AND HIGH VALUE MILITARY INSTALLATIONS**
50-50:	**MIX OF SDI DEFENSIVE SYSTEMS AND OFFENSIVE WEAPONS**
LIM:	**DEFENSIVE SYSTEMS WITH LIMITED RETALIATORY CAPABILITY**
DEF:	**SDI SYSTEMS ONLY, NO OFFENSIVE NUCLEAR WEAPONS**

Table 1. Strategies

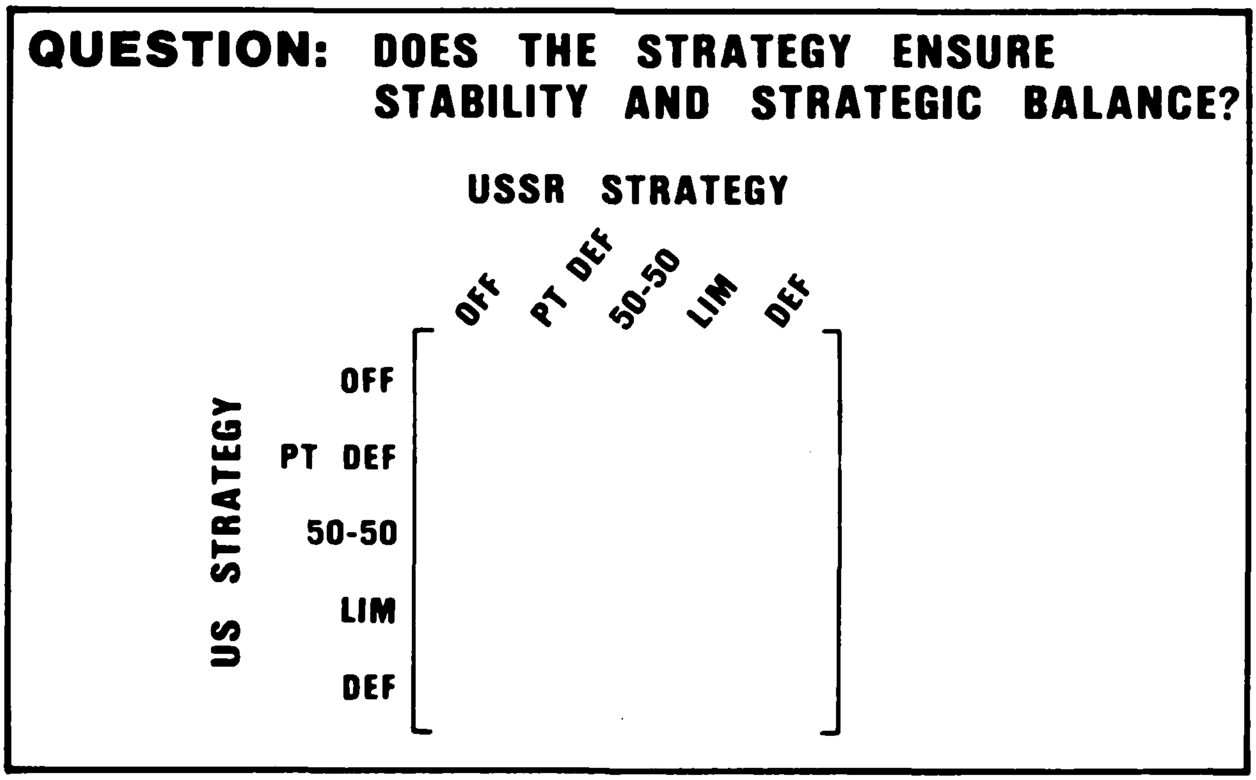

Figure 1. The Basic Matrix

* (GREEN) = YES/POSITIVE RESPONSE

* (RED) = NO/NEGATIVE RESPONSE

* (YELLOW) = UNKNOWN/NEUTRAL RESPONSE

* THIS SYMBOLOGY IS USED TO FACILITATE BLACK AND WHITE REPRODUCTION

Table 2. Coding Symbols

answers are from a U.S. perspective. They should not try to interpret Soviet response to this strategy. To facilitate this important consideration, a statement is placed at the bottom of the matrix.

Figure 2 shows a completed matrix. For this example there is no particular justification provided for any answers depicted, it is for demonstration purposes only.

The next step is to complete the identical matrix from the Soviet perspective. This will obviously require the recruitment of Soviet experts. Figure 3 illustrates a possible completed response.

ANALYSIS OF RESULTS

A cursory analysis of Figure 2 would lead to the conclusion that a 50-50 strategy for the U.S., or any strategy coupled with a Soviet defensive posture, would ensure stability from the U.S. perspective. Likewise, looking at Figure 3, any time the U.S. relied on a defensive only strategy, the Soviets would perceive stability. However, in the initial description of the objective, it was determined that both sides must perceive stability to in fact achieve a balance. To facilitate this analysis, the matrix approach lends itself to overlaying the responses, as in Figure 4.

Figure 4 illustrates an area (or trend) of common agreement--both sides perceive stability. As is often the case, the obvious is the best answer. Our analysis has confirmed that mutually assured destruction (MAD), a form of which has been U.S. strategy since World War II, is in fact a stabilizing strategy. Furthermore, the methodology suggests whatever strategy is chosen, as long as each side maintains equal capability, it will be seen as stabilizing.

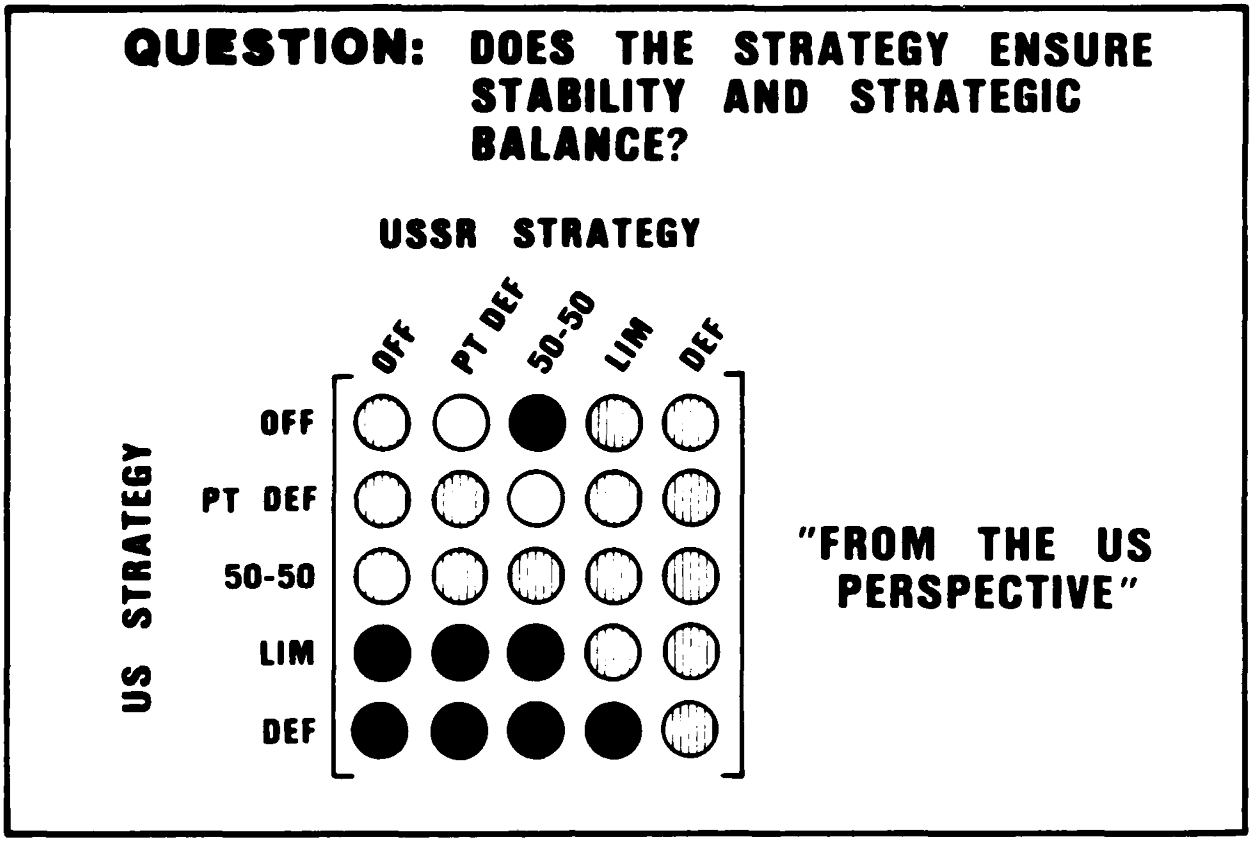

Figure 2. U.S. Perspective

There are two pitfalls to this result the analysis team should note. By analyzing the results, it becomes apparent that in transitioning to a strategy that includes defensive capability, it is essential each side have the same capability at the same time. If, even for a short period of time, one side has a perceived advantage, then the other side may be forced to react before losing their own capability. In addition, the logical consequence of the above situation is, to ensure equality at all stages, the U.S. may have to transfer technology and co-produce systems. These observations are an extension of the raw analysis critical to a complete analytical effort.

In conclusion, the reader is reminded that this simplified example is meant only to introduce the DMM methodology. Additional alternatives bring with them additional complexity. Clear trends may not appear and can dictate a reapplication of the methodology with new or reordered strategies, or even the use of a completely different technique. In addition, objectives and strategies may not align as conveniently as they did in this example. In the next chapter, different applications will be introduced along with limitations.

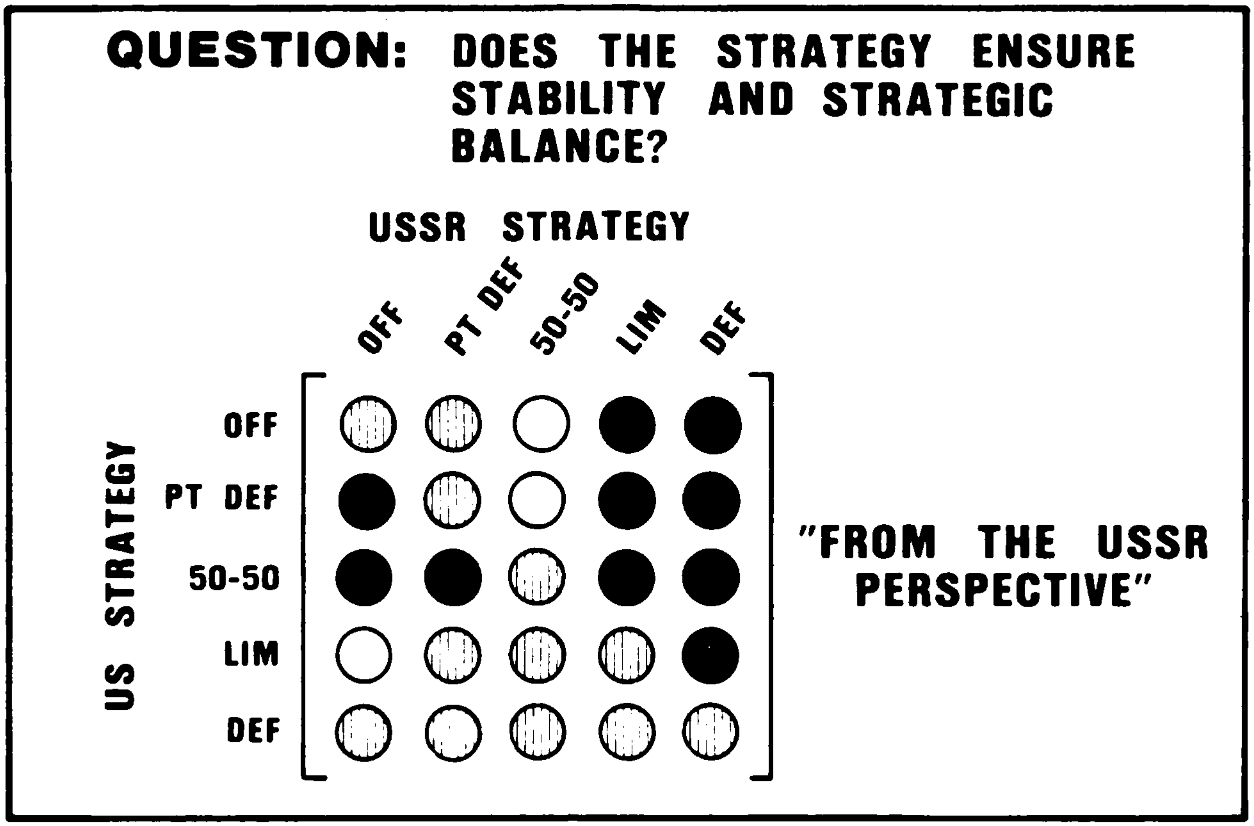

Figure 3. Soviet Perspective

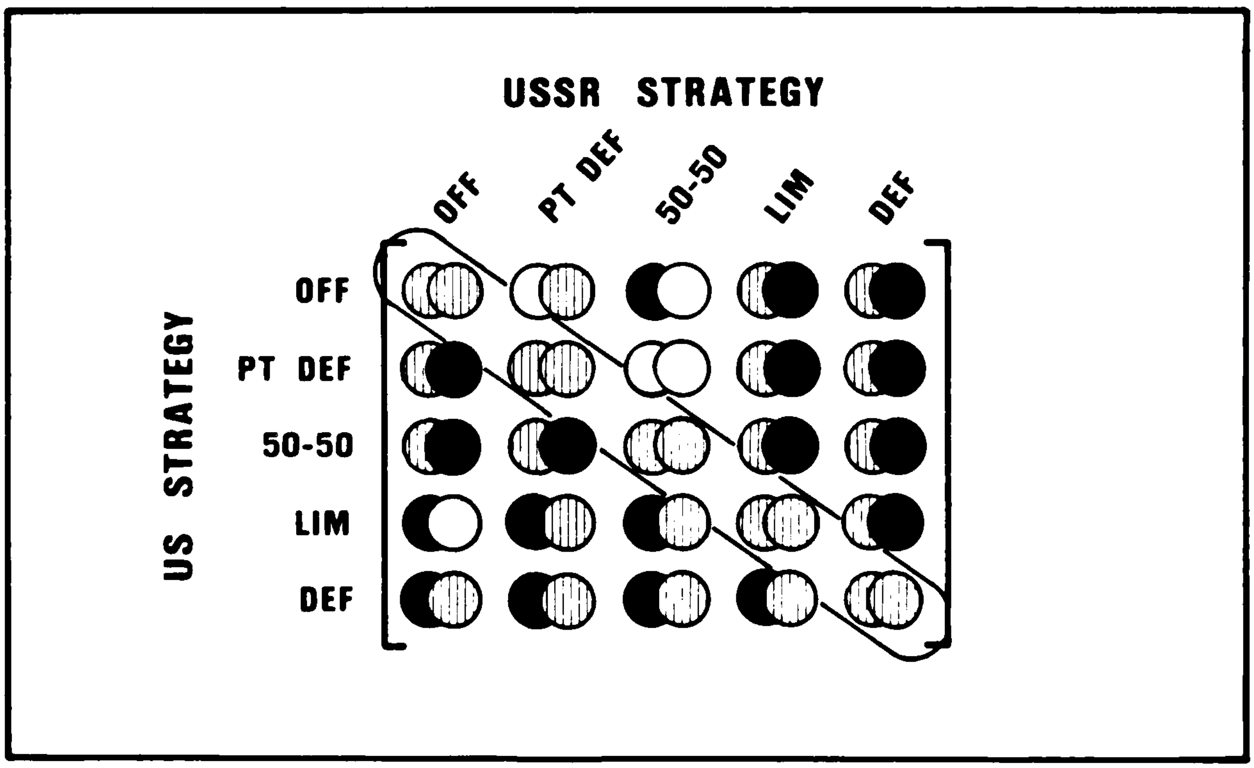

Figure 4. Matrices Overlayed

Chapter Four

CONCLUSIONS

OTHER APPLICATIONS

The example developed in Chapter Three represents an ideal application of the DMM methodology. It is characterized by symmetric strategies and the same objective for each side. Unfortunately, not all problems can be addressed within this structure.

Symmetric Opposing Strategies

This is the framework in which the deterrence example fits. As mentioned above, this application is characterized by symmetric strategies and an equivalent objective. When a problem falls into this form, the methodology facilitates the overlaying analysis depicted in Figure 4. Other problems that may be appropriate for this application include regional policy formulation, and battlefield strategy options.

Non-Symmetric Opposing Strategies

This application is appropriate when opposing sides have different strategies or different objectives. In the examples illustrated in Figures 5 and 6, note that because of different objectives, different questions were asked to complete the two matrices. The matrices can be overlayed (Figure 7), but little information is gained by having like responses in any position in the matrix. An analysis of the matrix in Figure 7 might, however, indicate policy makers could escalate involvement to the advisor level without invoking direct surrogate or Soviet involvement and still maintain public support.

Display

A less sophisticated application of the methodology involves using the matrix display to enhance understanding and possibly highlight trends. The example in Figure 8 is characterized by no opposing strategies, but rather a list of attributes. Each attribute is measured in terms of the coding symbol.

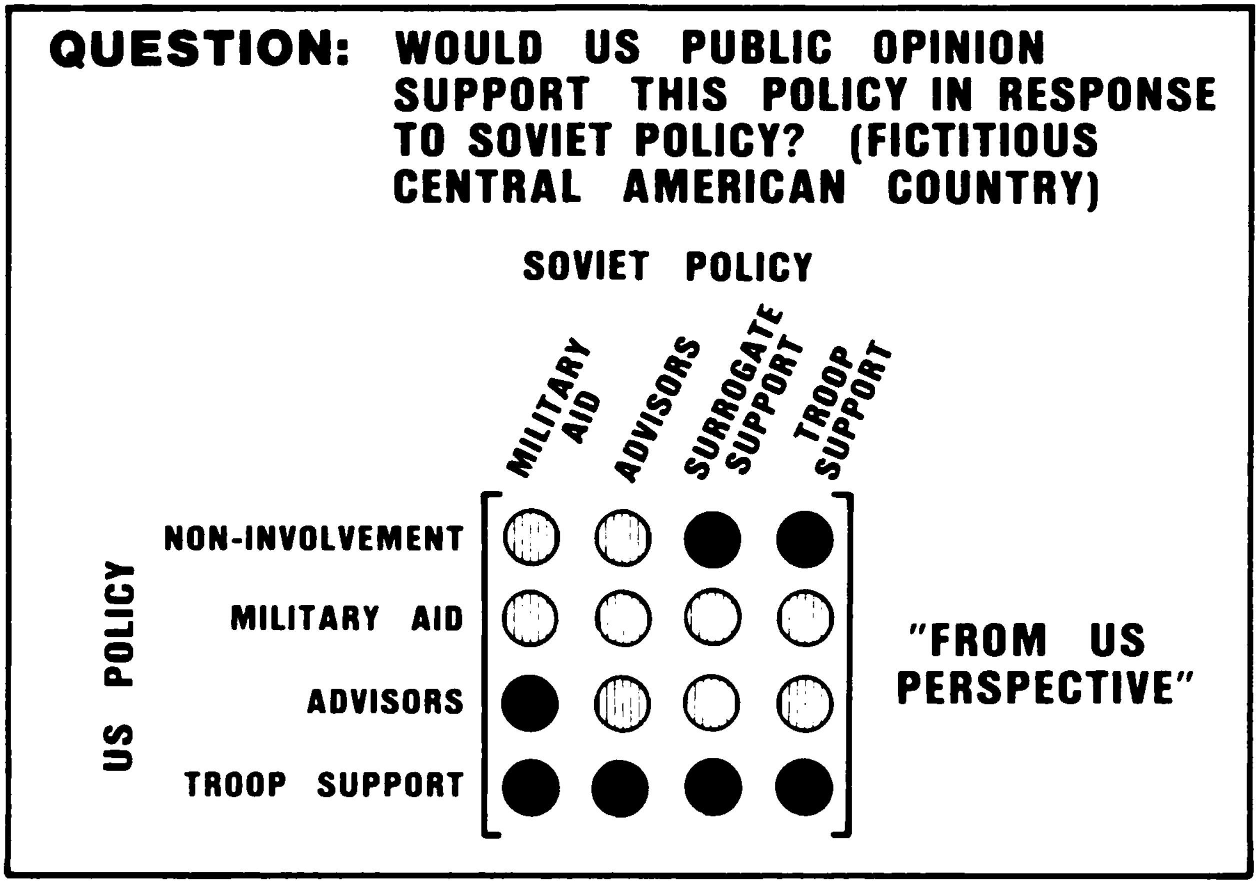

Figure 5. Non-Symmetric Strategies Matrix #1

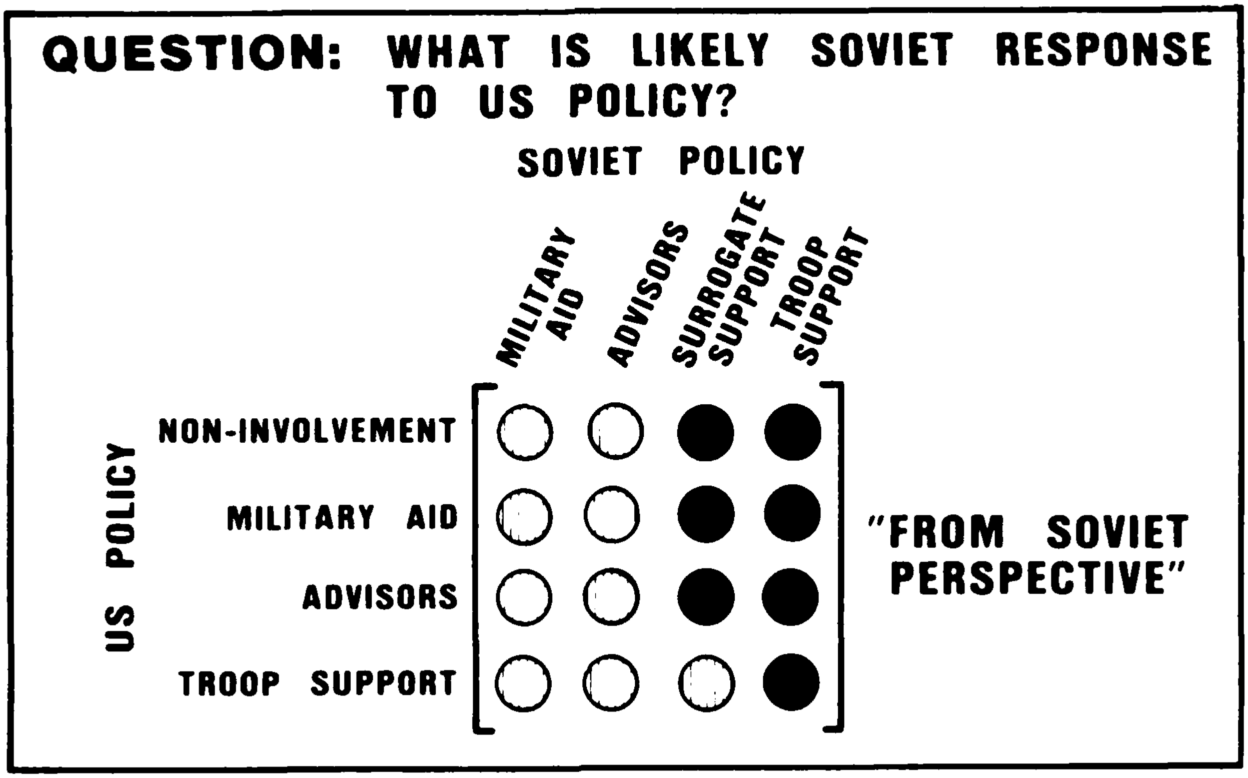

Figure 6. Non-Symmetric Strategies Matrix #2

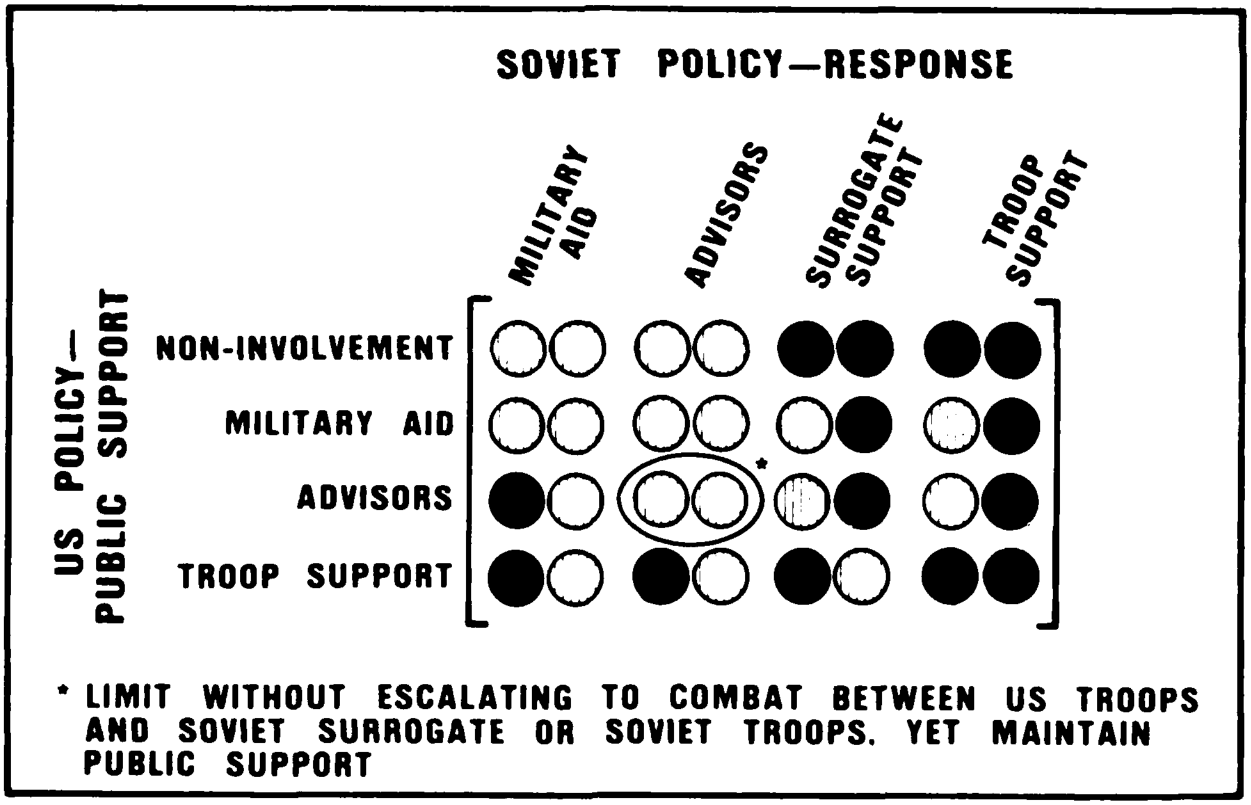

Figure 7. Non-Symmetric Strategies Overlayed

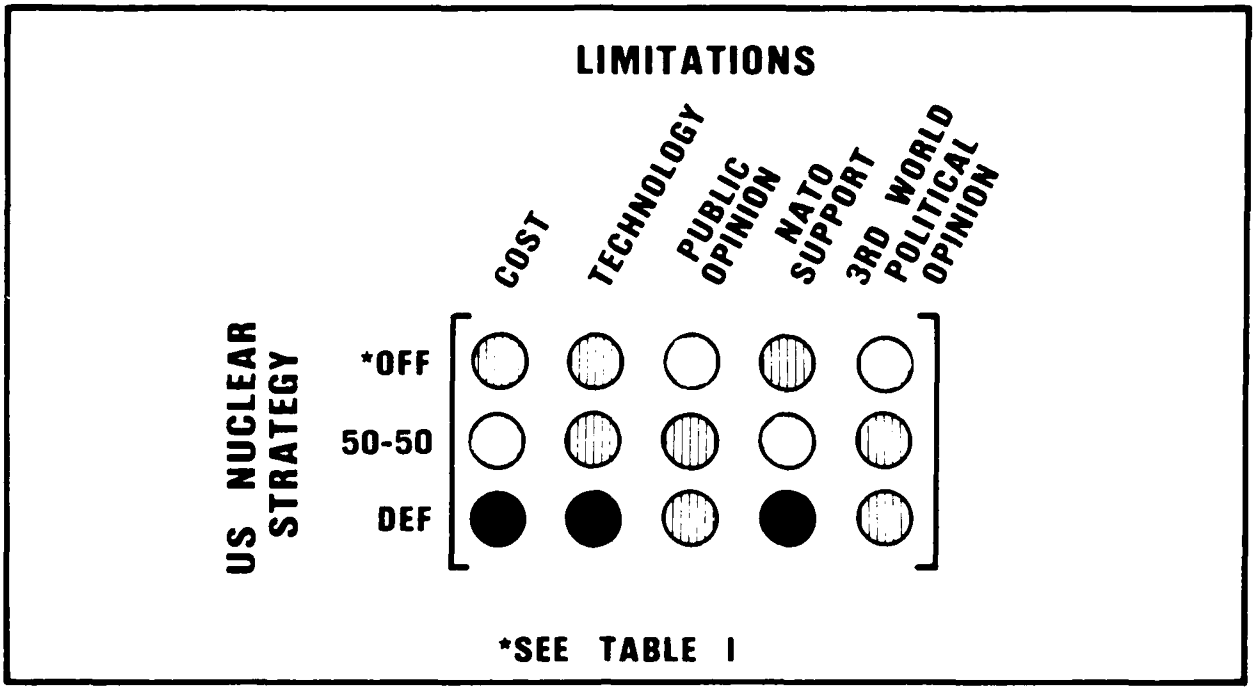

Figure 8. Display Matrix

LIMITATIONS AND OTHER CONSIDERATIONS

The basic principles relevant to any good analysis are also relevant for the DMM methodology. The objective must be clear and the methodology applicable. As with any decision analysis technique, the analysis team must guard against drawing their own conclusions. The team's primary responsibility is to be intellectually honest and thorough when determining strategies and completing the matrix. When presenting the methodology to the decision-maker, the team should offer enough explanation to build confidence in the decision-maker's mind that the matrix is a valid representation of the facts. It is then the decision-maker's responsibility to draw conclusions and provide guidance.

Any assumptions made during the analysis must be made clear to all participants. In our example, it was assumed SDI technology was achievable and the cost of deploying a system is not prohibitive.

Although a team of experts was stressed in the analytical process, there are alternatives to this approach. Often, if a large number of inputs are required, or if it is not practical to gather the experts in one location, a survey or questionnaire can be developed to meet the analyst's needs. However, you must guard against the pitfalls of surveys: 1) respondents often do not put the required intellectual effort into questionnaires, and 2) ambiguity and confusion can be expected by written questions

that lack the face-to-face discussion personal interviews and elicitations provide.

As mentioned in previous chapters, the ordering of strategies can be important. Consider, for example, a non-symmetric matrix that has a large number of alternatives. Although a clear cut strategy may not be evident, by properly ordering and prioritizing alternatives, the decision-maker may still be able to determine the proper direction to take by observing where the preponderance of positive responses lie. For example, the trend indicates a more offensively oriented nuclear strategy in Figure 2.

Finally, the success of this methodology is dependent, in large part, on the creativity of the analyst. This is not surprising information to most analysts. Choosing the proper analytical methodology, and the balancing act of fitting variables into the structure of a given methodology, is a great challenge.

SUMMARY

Decision-making has been described as "the act of comparing and discriminating among various alternatives to gain the knowledge necessary to make a rational choice." (5:5) The decision-making matrix methodology was designed to assist the decision-maker in discriminating between a large number of strategies in the context of a qualitative, long-range planning environment. The strengths of this approach are its relatively straight forward application and the simplicity of the display. Its major shortcoming is that its results are only as good as the analyst's skills and honesty.

In conclusion, analytical approaches to decision-making "force the decision-maker to define the problem, methodically consider the various relationships and help overcome many of the human perceptions that tend to inhibit the decision-making process. No matter how valuable a tool mathematics might be. . . it is not a substitute for human judgment." (5:6)

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